EXHIBIT A

SAE International™

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J1239

REV. FEB2003

Issued 1978-06
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Superseding J1239 OCT1995

Four-, Five-, and Eight-Conductor Electrical Connectors for Automotive Type Trailers

Foreword—This Document has also changed to comply with the new SAE Technical Standards Board format.

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1. ***Scope***—This SAE Recommended Practic covers the wiring and r ctangularly shap d conn ctor standards for all types of trailers whose gross weight does not exceed 4540 kg (10 000 lb). These trailers are grouped in SAE J684 with running light circuit loads not to exceed 7.5 A per circuit. This document provides circuits for lighting, electric brakes, trailer battery charging, and an auxiliary circuit color code and protection for the wiring from hazards or short circuits. Color code is compatible with SAE J560 and ISO 1724-1980(E).

2. ***References***

2.1 Applicable Publications— The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS— Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J560—Seven Conductor Electrical Connector for Truck-Trailer Jumper Cable
SAE J684—Trailer Couplings, Hitches and Safety Chains—Automotive Type
SAE J928—Electrical Terminals—Pin and Receptacle Type
SAE J1128—Low-Tension Primary Cable
SAE J2223-1—Connections for On-Board Road Vehicle Electrical Wiring Harnesses—Part 1: Single-Pole Connectors—Flat Blade Terminals—Dimensional Characteristics and Specific Requirements
SAE J2223-2—Connections for On-Board Road Vehicle Electrical Wiring Harnesses—Part 2: Tests and General Performance Requirements
SAE J2223-3—Connections for On-Board Road Vehicle Electrical Wiring Harnesses—Part 3: Multipole Connectors—Flat Blade Terminals—Dimensional Characteristics and Specific Requirements

2.1.2 ASTM PUBLICATION—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM G 90-94—Standard Practice for Performing Accelerated Outdoor Weathering of Nonmetallic Materials Using Concentrated Natural Sunlight

2.1.3 ISO PUBLICATION—Available from ANSI, 25 West 43rd Street, New York, NY 10036-8002.

ISO 1724-1980(E)—Road vehicles—Electrical connections between towing vehicles and towed vehicles with 6-or 12-V electrical equipment—Type 12 N (normal)

3. ***Receptacles***

3.1 Four-Way Receptacle—The four-way receptacle shall be of the configuration and design dimensions shown in Figure 1.

3.1.1 The four-way receptacle (Figure 1) shall be color coded and attached to the towing vehicle as follows:

a. White—Ground to frame SAE wire size 1 mm^2 (SAE wire size no. 16 gauge) minimum
b. Brown—Spliced to tail and license lamp circuit
c. Yellow—Spliced to left turn and stop circuit
d. Green—Spliced to right turn and stop circuit

3.2 Five-Way Receptacle—The five-way receptacle shall be of the configuration and design dimensions shown in Figure 2.

3.2.1 The five-way receptacle (Figure 2) shall be color-coded and attached to the towing vehicle as follows:

a. White—Ground to frame
b. Brown—Spliced to tail and license light circuit
c. Yellow—Spliced to left turn and stop circuit
d. Green—Spliced to right turn and stop circuit
e. Blue—Auxiliary

3.3 Eight-Way Receptacle—The eight-way receptacle shall be of the configuration and design dimensions shown in Figure 3.

3.3.1 The eight-circuit receptacle (Figure 3) shall be color-coded and attached to the towing vehicle as follows:

3.3.1.1 Left Bank of Receptacles

a. Red—Independent stop
b. Blue—Brake circuit spliced to controller of brake
c. Optional—Auxiliary (See Figure 3, Note 1)
d. Orange—Battery charge circuit-connect to battery positive terminal through separate fuse or circuit breaker

3.3.1.2 Right Bank of Receptacles

a. White—Direct to battery negative SAE wire size 3 mm^2 (SAE wire size no. 12 gauge) minimum
b. Brown—Spliced to tail and license lamp circuit
c. Yellow—Spliced to left turn and stop lamp circuit
d. Green—Spliced to right turn and stop lamp circuit

3.4 The receptacle leads shall be attached to the vehicle wiring harness in a workmanlike manner, mechanically and electrically secure. Further, a well-insulated strain relief shall be provided between the receptacle and the towing vehicle wiring harness connections so that there will be no strain on the vehicle harness in the event of an abnormal pull on the receptacle. The receptacle shall be placed in a location where it will not be exposed to road hazards either when connected or loose. The receptacle leads must be properly routed and protected against damage from cutting and pinching where they leave the vehicle body. Extra insulation should be provided between the strain relief at the trailer hitch and the wiring assembly so that an abnormal pull on the plug will not damage the wiring.

3.5 No receptacle leads designated for lighting shall be smaller than SAE wire size 1 mm^2 (SAE wire size no. 16 gauge) minimum if a single conductor, or smaller than SAE wire size 0.8 mm^2 (SAE wire size no. 18 gauge) if a multiconductor cable.

3.6 No receptacle leads for brake circuits shall be smaller than SAE wire 2 mm^2 (SAE wire size no. 14 gauge) and no circuits shall be smaller than SAE wire 3 mm^2 for (SAE wire size no. 12 gauge) trailer battery charge circuit or battery return circuit.

3.7 The gauge of conductors for the auxiliary circuits shall be sized to provide at least the maximum amperage for the load it will service with a voltage drop not exceeding 3%. The receptacle shall be placed in a location where it will not be exposed to road hazards when disconnected from trailer.

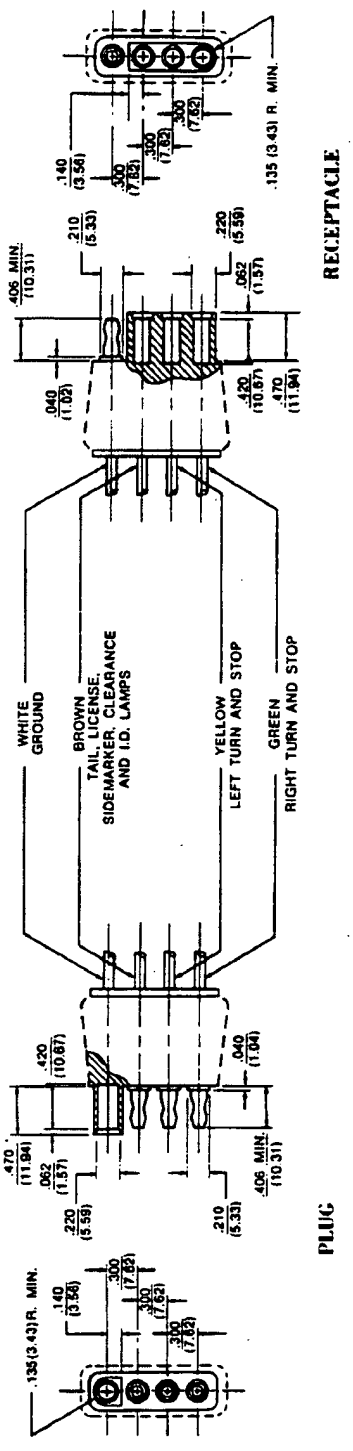


FIGURE 1—FOUR-WAY RECEPTACLE

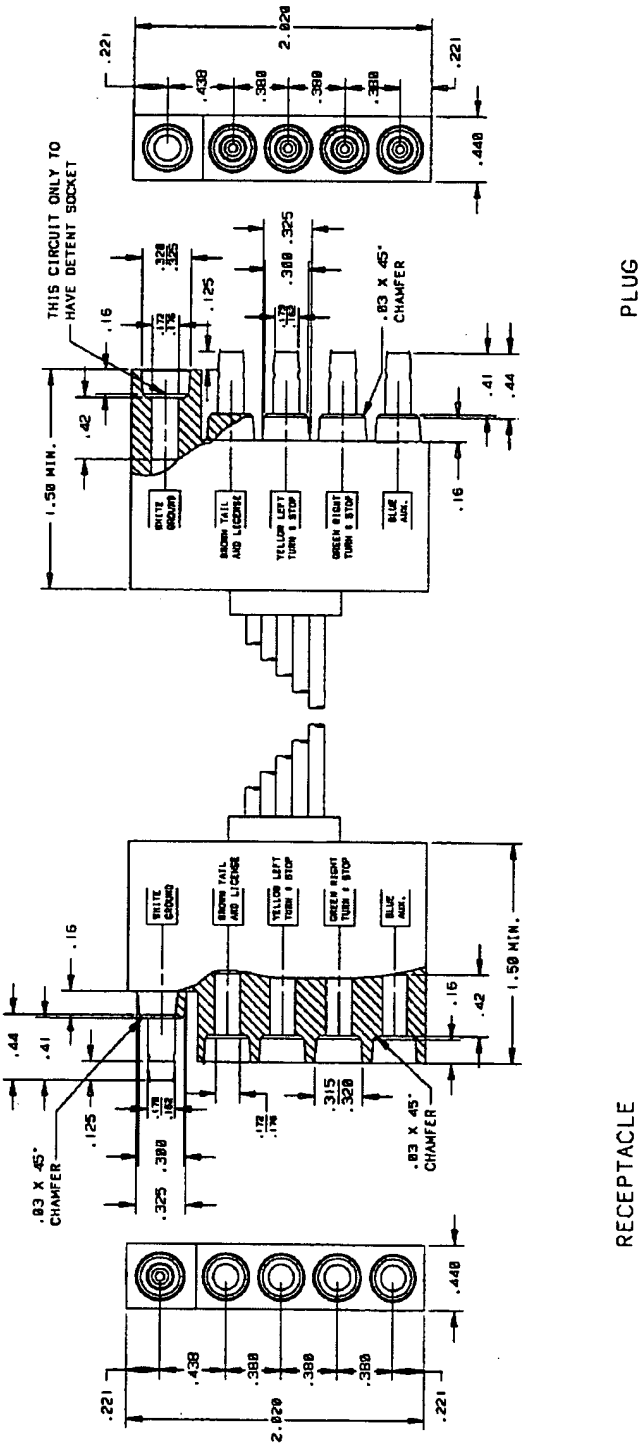


FIGURE 2—FIVE-WAY RECEPTACLE

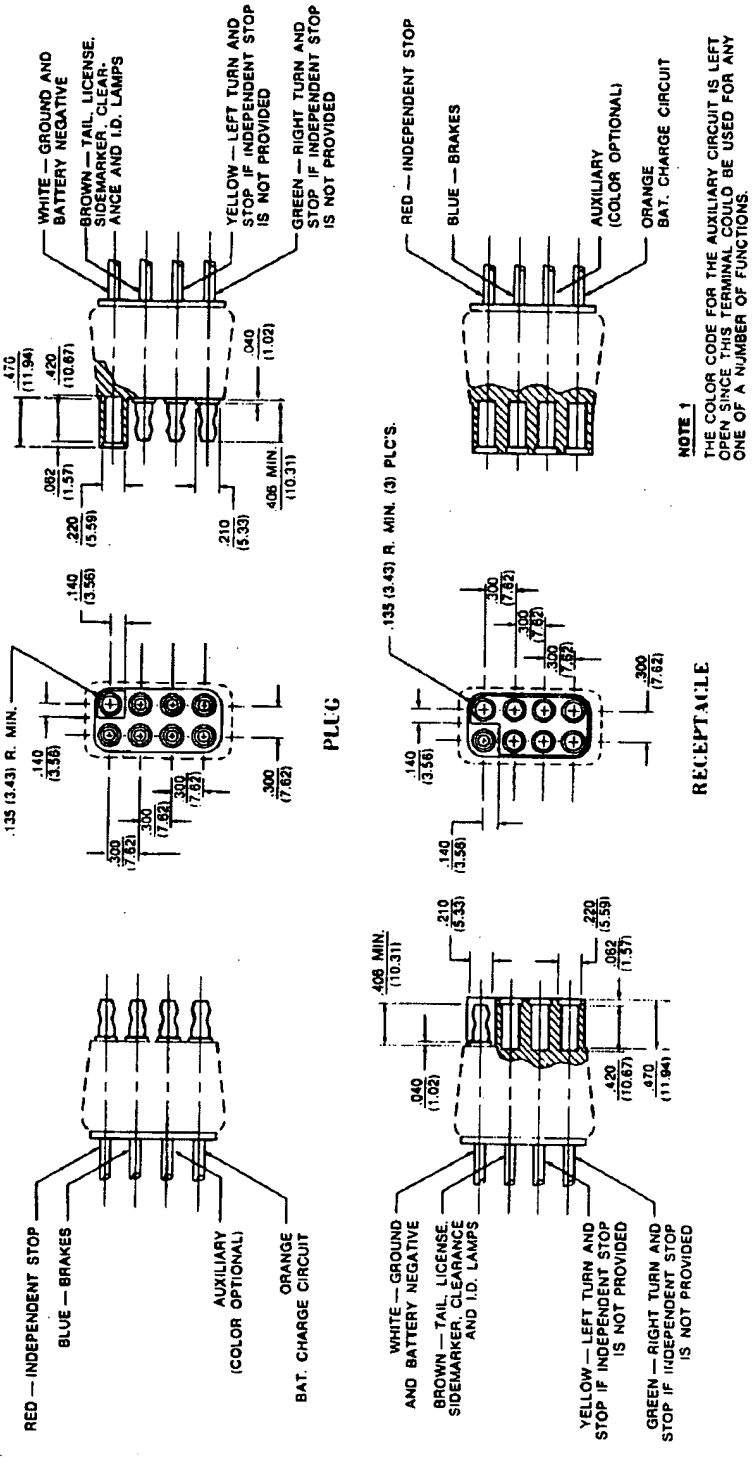


FIGURE 3—EIGHT-WAY RECEPTACLE

4. ***Plug***—The plug shall be of the configuration and design dim nsions shown in Figure 1 for four circuits, Figure 2 for five circuits, and Figure 3 for eight circuits.

4.1 Four-Way Plug—The four circuit plug (Figure 1) shall be color coded and attached to the trailer harness as follows:

a. White—Ground to frame SAE wire size 1 mm^2 (SAE wire size 16 gauge)
b. Brown—Spliced to tail and license lamp circuit
c. Yellow—Spliced to left turn and stop circuit
d. Green—Spliced to right turn and stop lamp circuit

4.2 Five-Way Plug—The five-circuit plug (Figure 2) shall be color-coded and attached to the trailer harness as follows:

a. White—Ground
b. Brown—Tail and license lamp
c. Yellow—Left turn and stop lamp
d. Green—Right turn and stop lamp
e. Blue—Auxiliary

4.3 Eight-Way Plug—The eight-circuit plug (Figure 3) shall be color coded and attached to the trailer harness as follows:

4.3.1 RIGHT BANK PLUG

a. Red—Independent stop
b. Blue—Brake circuit spliced to controller of brake circuit
c. Optional—Auxiliary (See Figure 3, Note 1)
d. Orange—Battery Charge Circuit—Connect to trailer battery positive terminal through separate fuse or circuit breaker

4.3.2 LEFT BANK PLUG

a. White—Ground to frame and trailer battery negative terminal
b. Brown—Spliced to tail and license lamp circuit
c. Yellow—Spliced to left turn and stop lamp circuit
d. Green—Spliced to right turn and stop lamp circuit

5. ***Wiring***—All wire and insulation shall conform to the requirements of SAE J1128 Reference Low Tension Primary Cable data on stranded conductors for 12-V circuits with 3% voltage drop. (See Appendix A, Figures A1 and A2.)

5.1 Exposed trailer wiring shall be run in conduits or secured at intervals not greater than 457 mm (18 in) to stop lateral movement and prevent rubbing or chafing.

5.2 So far as practicable, wiring should be located to afford protection from road splash, stones, or abrasion. Wiring exposed to such conditions shall use additional tape, plastic sleeve, nonmetallic conduit, and/or other suitable shielding or covering to further protect the wiring.

6. *Material Requirements*

6.1 The receptacle and plug shall be made of an insulating material such that they can be processed to provide the spacing and splash protection indicated in Figures 1, 2, and 3.

6.2 If the receptacles and plugs are fabricated of either compression molded or extruded plastic, the plastic material shall be stabilized for protection against exposure to ultraviolet light. Reference to ASTM G 90-94 for conducting a general test on plastic material using a radiometer to measure radiant energy incidents upon a unit surface over a unit of time per area and accelerating outdoor exposures with a fresnel reflector concentrator. The practice does not specify materials to be tested. Sample preparation and evaluation of results are covered by existing specifications for specific materials.

6.2.1 The hardness of a molded receptacle or plug shall generally fall within the limits of Shore A 50 as minimum and Shore A 70 as a maximum. Shore A 85 has also been known to perform well if properly reinforced and stabilized.

6.3 The terminal pins and receptacles sockets shown in Figures 1, 2, and 3 shall conform to the size and type shown in SAE J928, TABLE 1—TYPE 1 PIN TERMINALS with a nominal diameter of 4.57 mm (0.180 in). Detailed pin and receptacle dimensions are illustrated in Figures 4 and 5.

6.3.1 The terminal pins and receptacles shall be fabricated from brass or bronze material and suitable coated to protect against corrosion. Finished surfaces of terminal pins and interior walls of terminal receptacles shall be smooth so as not to bind when the parts are engaged.

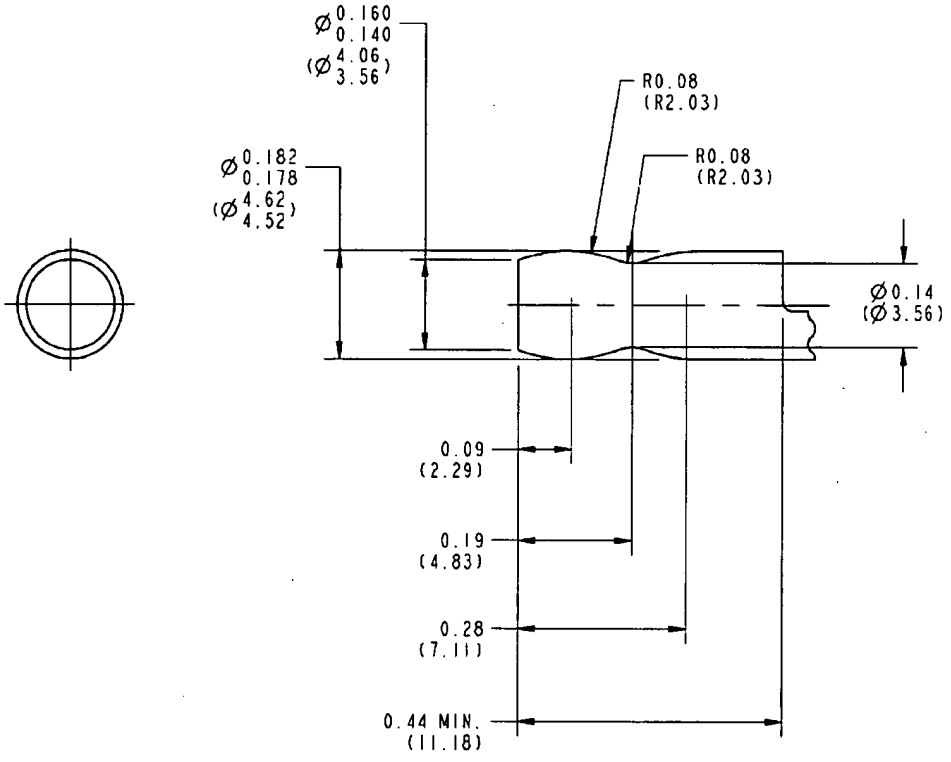


FIGURE 4—PIN

7. Assembly Requirements

7.1 The plug and receptacle of a four-way conn ctor assembly shall disengage with a minimum force of 22.24 N (5 lb) per assembly and a maximum force of 88.96 N (20 lb) per assembly.

7.2 The plug and receptacle of a five-way connector assembly shall disengage with a minimum force of 13.34 N (3 lb) per circuit and a maximum of 31.14 N (7 lb) per circuit except the ground circuit, which can be 53.38 N (12 lb) maximum.

7.3 The plug and receptacle of an eight-way connector assembly shall disengage with a minimum of 35.58 N (8 lb) per assembly and a maximum force of 133.44 N (30 lb) per assembly.

7.4 The mechanical force requirements of disengagement do not preclude the requirements for good electrical connections between the male and female connectors of the circuits.

NOTE: THIS SOCKET TO BE USED ONLY ON THE GROUND CIRCUIT OF THE MOLDED PLUG. SOCKETS SIMILAR TO THIS, EXCEPT WITH THE DETENT OMITTED, ARE TO BE USED IN THE MOLDED RECEPTACLE.

METAL STOCK SHOULD BE OF ¾ HARD TEMPER BRASS OR BRONZE MATERIAL.

REFERENCE DIMENSIONS ARE IN MILLIMETERS

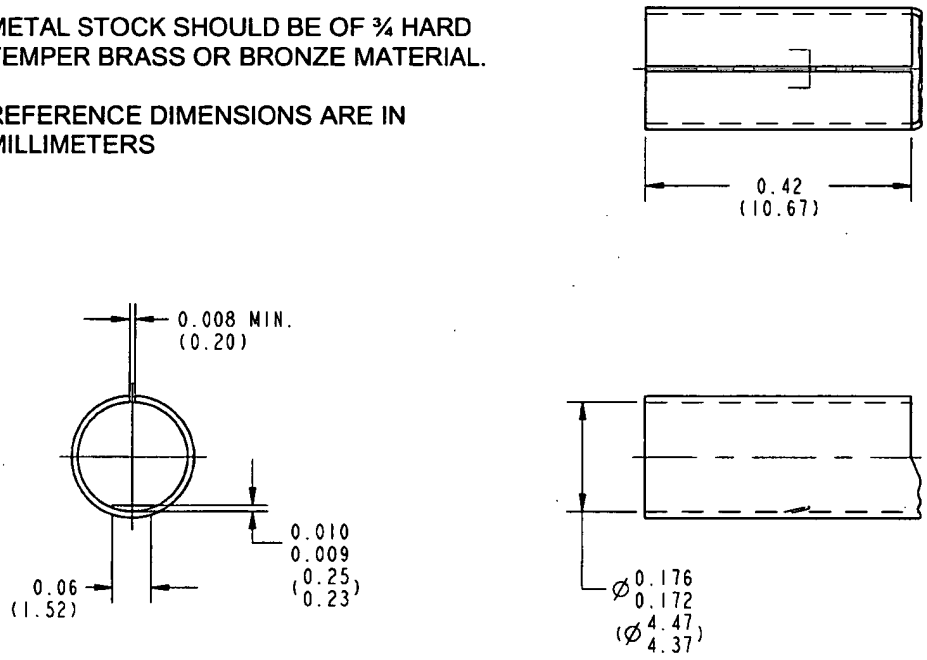


FIGURE 5—SOCKET

8. Alternate Connector Selection—This specification provides fundamental performance characteristics pertaining to mold-on connectors, which have been established for Class I trailer applications. There is no intention to limit th application to the exampl four-, five-, and eight-way pin/sl eve connectors, provided that mating pair conn ctors have equal or superior performanc characteristics. Also, additional performance standards for connectors can be referenced in SAE J2223-1, SAE J2223-2, and SAE J2223-3.

9. Notes

9.1 **Marginal Indicia**—The change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. An (R) symbol to the left of the document title indicates a complete revision of the report.

PREPARED BY THE SAE ELECTRICAL DISTRIBUTION SYSTEMS STANDARDS COMMITTEE

APPENDIX A

REQUIREMENTS FOR STRANDED CONDUCTORS FOR 12-V CIRCUITS

SAE Wire Size	20	18	16	14	12	10
Stranding	7 x 28	16 x 30	19 x 29	19 x 27	19 x 25	19 x 23
Metric Wire Size	0.5	0.8	1.0	2.0	3.0	5.0
Min Conductor Area (Cir Mil)	1072	1537	2336	3702	5833	9343
Min Conductor Area (mm^2)	0.508	0.760	1.12	1.85	2.91	4.65

NOTE— This abstracted table is not intended to limit conductor constructions but samples the stranding range shown.

FIGURE A1—STRANDED CONDUCTORS FOR 12-V CIRCUITS
(PRIMARY CABLE DATA ABSTRACTED FROM J1128) 3% VOLTAGE DROP

SAE Wire Size	0.5 mm	(20)	0.8 mm	(18)	1 mm	(16)	2 mm	(14)	3 mm	(12)	5 mm	(10)
Circuit Current in AMPS	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft
1	12	39.4	16	52.5	24	78.7						
2	6	19.7	8	26.2	12	39.4	19.5	64	30.5	100.0		
3	4	13.2	5.5	19.7	8	26.2	13	42.7	20.5	67.2		
4	3	9.8	4	13.1	6	19.7	10	32.8	15	49.2	24	78.8
5	2.5	8.2	3.5	11.5	5	16.4	8	26.2	12	39.4	19.5	63.9
6	3	9.8	3	9.8	4	13.1	6.5	21.3	10	32.8	16	52.5
7	2	6.6	2.5	8.2	3.5	11.4	5.5	18.1	9	29.5	14	45.9
8			2	6.6	3	9.8	5	16.4	8	26.2	12	39.4
9			2	6.6	3	9.8	4.5	14.8	7	23.0	11	36.1
10			2	6.6	2.5	8.2	4	13.1	6	19.7	10	32.8
15					2	6.6	3	9.8	4	13.1	6.5	21.3
20							2	6.6	3	9.8	5	16.4

FIGURE A2—MAXIMUM LENGTH OF CONDUCTOR IN FEET FROM POWER SOURCE TO LOAD

Rati nale—Not applicable.

Relationship f SAE Standard to ISO Standard—Not applicable.

Application—This SAE Recommended Practice covers the wiring and rectangular shaped connector standards for all types of trailers whose gross weight does not exceed 4540 kg (10 000 lb). These trailers are grouped in SAE J684, with running light circuit loads not to exceed 7.5 A per circuit. This document provides circuits for lighting, electric brakes, trailer battery charging, and an auxiliary circuit color coding and protection for the wiring from hazards or short circuits. Color coding is compatible with SAE J560 and ISO 1724-19805(E).

Reference Section

SAE J560—Seven Conductor Electrical Connector for Truck-Trailer Jumper Cable

SAE J684—Trailer Couplings, Hitches and Safety Chains—Automotive Type

SAE J928—Electrical Terminals—Pin and Receptacle Type

SAE J1128—Low-Tension Primary Cable

SAE J2223-1—Connections for On-Board Road Vehicle Electrical Wiring Harnesses—Part 1: Single-Pole Connectors—Flat Blade Terminals—Dimensional Characteristics and Specific Requirements

SAE J2223-2—Connections for On-Board Road Vehicle Electrical Wiring Harnesses—Part 2: Tests and General Performance Requirements

SAE J2223-3—Connections for On-Board Road Vehicle Electrical Wiring Harnesses—Part 3: Multipole Connectors—Flat Blade Terminals—Dimensional Characteristics and Specific Requirements

ASTM G 90-94—Standard Practice for Performing Accelerated Outdoor Weathering of Nonmetallic Materials Using Concentrated Natural Sunlight

ISO 1724-1980(E)—Road vehicles—Electrical connections between towing vehicles and towed vehicles with 6-or 12-V electrical equipment—Type 12 N (normal)

Developed by the SAE Electrical Distribution Systems Standards Committee

EXHIBIT B

The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

SAE/USCAR-4

Issu d November 1997

STANDARD FOR CIGAR LIGHTERS & POWER OUTLETS

SUMMARY OF CONTENTS

QUESTIONS REGARDING THIS DOCUMENT: (724) 772-8545 FAX (724) 776-0243
TO PLACE A DOCUMENT ORDER: (724) 776-4970 FAX (724) 776-0790

1. SCOPE:

1.1 Authority:

This standard is promulgated by the United States Council for Automotive Research (USCAR), Electrical Wiring Component Application Partnership (EWCAP). Development was under a task force consisting of representatives from the USCAR participants. Application of this standard to the covered components is covered by the individual purchase documents of each customer. The intent of this document is to standardize the electrical interface to the vehicle, the mechanical interface to a mounting panel or surface, and the general operational specifications of these devices. The intent of this specification is to fully define industry-wide acceptance characteristics and testing required for installation and reliable operation. These criteria will ensure that commonality and enhanced interchangeability are achievable for all end users.

1.2 Scope:

This standard is intended to cover cigar or cigarette lighters as well as power outlets based on the form and dimensions of the cigar lighter. This standard is a full performance specification, it includes dimensional and operational parameters as well as performance characteristics which must be met when submitting a cigar lighter assembly or power outlet assembly for production approval. This standard constitutes an acceptance specification for a surface mounted, front-loaded cigar lighter or power outlet.

1.3 Coverage:

This standard covers the operational, reliability, durability, acceptance, and testing requirements for a front loaded, external contact, cigar lighter (lighter) for installation in production vehicles. This standard also covers power outlets that are based on the form and dimensions of the lighter receptacle.

Testing shall be done on part families as directed by the appropriate corporate engineering platform group(s). Part family definition shall be made by the purchaser as part of the purchase agreement.

1.4 Purpose of the Part:

The lighter is provided as a convenience, for use in lighting cigars and cigarettes, and for use as a power outlet. The intent is to provide a lighter which is usable with as little distraction as possible to the primary function of safe vehicle operation, and is relatively safe while using a device which may reach functional temperatures in excess of 650°C.

When designed as a power outlet, or as a lighter used as a power outlet, the device is exposed to a variety of devices beyond the automotive industry's control. Among the most important of these is the accessory plug which interfaces to the lighter or power outlet base. Recommended accessory plug design criteria is provided in paragraph 5.4 of this specification.

1.5 Part Description and Glossary:

Throughout this standard, descriptions will be employed to reference various components. Special names/terms will be defined at first usage in the text, with the usage name/term shown in parentheses immediately following. The text usage will be continued thereafter. For purposes of this document, the following will be used:

DEVICE - (Device) Any of the components separately or as a group.

LIGHTER ASSEMBLY - (Lighter) A complete system of components; including the element assembly, a receptacle, and some form of mounting ring which taken together constitute a cigar/cigarette igniting system.

ELEMENT ASSEMBLY- (Element) An assembly containing a heating element and knob, a shield or ash guard, and other internal components. Commonly referred to as the popout or knob/element assembly.

RECEPTACLE ASSEMBLY- (Receptacle) That portion of the system constituting the element well, the electrical connections, the over-temperature device, and thermal release mechanism. Usually installed in the passenger compartment, this device receives, heats, and stores the element when not in use. Alternatively called the housing or switch base.

HALO RING / MOUNT RING - This mounting ring, usually molded of an opaque plastic, serves to position and mount the receptacle to intended parent panel in the vehicle.

The "Halo" Ring is intended for illuminated operation. The "Halo" Ring is identical with the mounting ring, but is of a translucent colored material and usually contains a light source. Illumination is normally intended to be powered from the dimmable instrument panel light circuit. Color match with the rest of the illuminated I/P components is achieved through this material.

The mounting ring and the halo ring are intended to be interchangeable, both in function and application on the lighter or outlet receptacle and in the mounting hole, and may be substituted for one another depending on illumination requirements. When the halo ring contains a light source it shall get its B+ from the auxiliary contact of the receptacle and its ground from the ground of the receptacle through a connection that self-mates during installation of the receptacle into the ring.

POWER OUTLET or POWER POINT RECEPTACLE - (Receptacle) This device is similar in appearance to the lighter receptacle, but without thermal release or thermal over-temperature provisions, it is provided for the sole purpose of connecting after market devices to the vehicle electrical system. In this specification, the term receptacle shall refer to both the cigar lighter or power point receptacle, unless specifically identified.

POWER OUTLET PLUG - A plug specifically designed to insert into a receptacle making contact with the receptacle shell for the ground connection and to the B+ contact in the center bottom of the receptacle. For purposes of testing the receptacles as power outlets, a plug meeting the requirements paragraph 5.4 shall be used.

1.5 (Continued):

BUZZ, SQUEAK, AND RATTLE (BSR) - This term is applied to any number of annoying sounds within the vehicle. As vehicles become quieter, BSR becomes more important.

1.6 Hazardous Material Control:

Products furnished under the authority of this document and products and processes used by suppliers to manufacture those products must conform to health and safety requirements of the Occupational Safety and Health Administration.

2. REFERENCE DOCUMENTS:

Resolution of document precedence in the event of a conflict between performance standards, part drawings, and related standards or specifications shall be as follows unless otherwise specified below, or in a specific contract or purchase order:

1st-Applicable Part Drawing(s)
2nd-This standard
3rd-Other USCAR Performance standards and specifications
4th-Other related standards and specifications

Nothing in this specification, however, supersedes applicable laws and regulations unless specific exemption has been obtained.

Suppliers are expected to be aware of, and comply with, worldwide (e.g. North American, European, Asian, Gulf States) vehicle standards unless specific exemption has been obtained from the customer.

Any logo or symbol applied to the knob (when required) shall be configured to meet ISO requirements.

2.1 Part Drawing:

The component part drawing shall contain, at a minimum, the following information:

- A reference to this specification for interface and testing requirements,
- All part dimensional requirements not covered herein, including any orientation (keying) requirements,
- Performance requirements not covered herein, such as material standards and component specifications,
- Conformance requirements not covered herein, such as other corporate or industry standards or regulations, domestic or foreign,
- Typical mating connector, terminal, and illumination requirements (including dimensions where required).

2.2 Customer & Industry Standards:

Suppliers are expected to subscribe to the Standards listed on the part drawing. Additional standards may be referenced throughout this document as required. Unless otherwise specified, suppliers should use the most recent versions of any referenced document(s) or standard(s).

2.2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J563 Six- and Twelve-Volt Cigar Lighter Receptacles

2.2.2 ASTM Publications: Available from ASTM, 100 Barr Harbor, West Conshohocken, PA 19428-2959.

ASTM B117 Standard Practice for Operating Salt Spray (Fog) Testing Apparatus

2.2.3 AIAG Publications: Available from AIAG, 26200 Lahser, Suite 200, Southfield, MI 48034.

AIAG Production Part Approval Process
AIAG Quality System Requirements - QS 9000

2.2.4 FMVSS Publications: Available from the Superintendent of Documents, U.S. Government Printing Office, Mail Stop SSOP, Washington, DC 20402-9320.

FMVSS-302 Federal Standard - Flammability of Interior Materials

2.3 Failure Mode and Effect Analysis (FMEA):

Within 90 days of source selection, per the Automotive Industry Action Group (AIAG) requirements, the supplier must submit a preliminary Design FMEA (DFMEA) based on the current design concept, to the project engineer for review. A revised FMEA must be submitted 10 weeks prior to program tooling release and must be approved by the project engineer prior to tooling release. The supplier must complete a Process FMEA (PFMEA) at least 90 days prior to production validation testing. The Process FMEA must be submitted to both the project engineer and the appropriate Supplier Quality representative for approval. It is recognized that these are "living" documents, and that change is expected, therefore, it is most important that FMEA status be maintained as current as possible.

3. GENERAL REQUIREMENTS:

3.1 Interface Design Requirements:

3.1.1 Electrical Interface: The electrical interface to the vehicle wiring harness shall be based on a three terminal connection consisting of a Primary B+ contact providing current for the primary function (lighter or outlet), a Ground contact providing a return path for all functions, and, if illumination is included, a Secondary B+ contact providing current for the illumination device. Pin locations are defined in Fig 2E. Detail dimensional requirements are shown in Fig 2.

3.1.2 Mechanical Mounting: The mechanical interface between the receptacle and panel will be accomplished with a mounting ring.

The mounting ring shall lock into a circular hole in the parent panel of 27.8 mm (+0.25, -0.00 mm) diameter (See Fig 3). The panel shall be flat and a uniform 2.75 mm (+0.25 / -0.25 mm) thick at the mounting hole and for a distance of 5.0 mm around the hole. The flat area shall be perpendicular to the central axis of the installed device. The parent panel should be designed to withstand a 260 N force applied along the axis of the receptacle in either direction. If keying is required it shall be as shown in Fig 3.

Installation shall be accomplished by inserting mounting ring into the parent panel and then inserting the lighter into the mounting ring. Locking action is accomplished via a minimum of two tabs which are displaced outward to grip the panel from the mount ring by the receptacle passing through. When fully seated, the receptacle is locked to the mount ring by way of molded bosses engaging the receptacle. The manufacturer shall provide a method of indexing or alignment to insure orientation between components during installation.

Where an illuminated mounting ring (halo/glow ring) is used, the panel mounting hole size, retention features, and force requirements shall remain the same as a non-illuminated mounting ring. The illumination feature(s) shall be so designed as not to interfere with mounting ease, nor require any additional installation steps over the non-illuminated mounting ring. Lamp connection(s) shall be made automatically without a separate connection to the vehicle system, through the auxiliary terminal provided in the device connector.

3.2 Supplier Responsibilities:

The device supplier(s) shall be wholly responsible for all activities regarding design, development, conformance testing, and manufacture of the subject part within the stated time frame in order to meet all functional and quality objectives as stated in this standard. Specific supplier responsibilities are listed throughout this standard. The supplier must be prepared for Production Part Approval prior to series production. Detailed instructions for this process are found in the AIAG publication: "Production Part Approval Process" (PPAP).

Subject to the approval of purchasing and material handling, devices must be packaged for shipment to avoid any potential for damage. Excessive handling of raw materials, subcomponents, and finished assemblies should be minimized to avoid potential damage.

All shipments from the manufacturer shall be in the sequence of manufacture; first in, first out.

3.3 Record Retention:

The supplier shall maintain a centralized file system for the storage of laboratory reports, calibration records, and testing documentation. A retention policy concerning these records shall be established. This file shall be periodically audited by the following representatives; product engineering, purchasing, quality, and reliability. Outside audits shall occur only with customer concurrence. Unless otherwise specified, record retention shall be for a minimum 10 year period.

The reasons for compilation and retention of records are:

. Maintain records showing proof of compliance in the accomplishment of the objectives stated in this standard.

. Retain records proving that "due care" was exercised in the development and testing of the product represented by this standard.

. To comply with legal requirements for the maintenance of specific records.

3.4 Test Philosophy:

3.4.1 Design Verification Testing: Design Verification (Development) tests are used to evaluate specific designs or areas of designs. They are to be used as a tool for evaluating design alternatives, proposed improvements, or determining root causes of field problems. This type of testing will, at a minimum, include the tests described herein, but may also include tests of a more stringent or destructive nature.

3.4.2 Production Validation Testing: Production Validation (Sample Approval) tests are those necessary to qualify the device for production and use in automobiles. They are covered by the requirements of this specification.

3.4.3 Continuing Conformance Testing: Continuing Conformance testing is used to insure that the agreed upon parameters are being adhered to during the production life of the part. Generally, these tests are conducted when a new component is introduced, when any change is made to subcomponents, when tooling or manufacturing location change, and periodically during each model year as required by the purchase agreement, even if the part has not been changed.

At least once per year, a minimum of 10 samples (element/knob & base, etc.) shall be placed on an automated cycle tester and cycled until failure, or three times life, whichever occurs first. The test shall be essentially the same as a durability life test.

4. PERFORMANCE & TESTING REQUIREMENTS:

These devices shall be capable of operating in the typical automotive interior environment without deforming, loosening, or otherwise adversely affecting the appearance or operation of the vehicle, the device, and/or any adjacent components. The testing procedures described in this standard are designed to quantify particular component characteristics to meet this requirement. All deviations from this specification must be recorded and reported at the time of submission of test results.

Acceptable standards of performance for each test are listed and detailed within the section describing that particular test. Some attributes may be determined by visual inspection or by measurement. Tolerances, and procedures, for making these measurements will also be listed where applicable.

4.1 Duty Cycle Definition:

For this standard, the following is considered one duty cycle:

LIGHTER: A lighter cycle consists of the following: Inserted and ready (heated or not); engaged and heating; released; withdrawn and reinserted; and back to ready.

POWER OUTLET: An outlet cycle consists of insertion of a plug with a load connected for a period of time and then withdrawal with the load still connected. The outlet load shall be a mixture of 25% of the cycles at a 20 A load for a period of 15 minutes, and 75% of the cycles at a 5 A load for a period of 5 minutes. The test time may be accelerated with the concurrence of the project engineer.

4.1.1 Reliability Test Requirements: The following shall be checked at each cycle unless otherwise noted:

a. Insertion force (once per day)
b. Excessive Engagement force *(for lighters)*
c. Failure to engage or to remain engaged *(for lighters)*
d. Failure to release within the time limit *(for lighters)*
e. Withdraw force (once per day)
f. Temperature profile (once per day) *(for lighters)*
g. Current continuity without interruption *(for outlets)*

If any lighter fails to engage within the maximum force, fails to remain engaged, fails to release as specified, or fails the temperature profile, the test should be paused, and the cause determined before continuing with the unfailed samples. If any device exceeds the insertion or withdraw forces, the cause should be determined and the offending component removed from test. If any outlet fails to carry the specified current for the specified cycle time without interruption, the cause shall be determined before continuing with the unfailed samples.

4.1.1 (Continued):

A replacement device may be installed in place of a failed unit in order to continue testing a mating component or to balance the forces within the test fixture, however the replacement unit is not to be included in the sample size or calculations.

If portions of this test are done as separate tests, the results shall be combined statistically to indicate the total reliability value of the lighter assembly.

4.2 Functional Requirements:

Specific requirements for each functional characteristic are listed below in the appropriate paragraphs.

4.2.1 SAE Standard: The lighter shall meet the requirements of Style "A" of SAE J563. Dimensional requirements involving maximum and minimum diameters of the ground lance fingers and of the bi-metal thermostats shall be followed.

4.2.2 Flammability: Material(s) used in the construction of parts covered by this standard shall meet the flammability requirements of FMVSS 302.

4.2.3 Thermal Performance:

4.2.3.1 Initial Release: With the device at a stabilized temperature of 25° +/- 5°C, the element shall release within 20 seconds of being engaged for heating. The release time shall not exceed 25 seconds at any stabilized ambient temperature from -20°C to +55°C. An average of three readings shall be used to determine compliance.

4.2.3.2 Heat Profile: The heated element will provide a uniform heat pattern across the surface of the element. Minimum temperatures at ejection shall be as follows:

After 10 sec	480°C
After 20 sec	380°C

4.2.3.3 Reenergizing: After initial release and removal for at least 60 seconds, the element assembly shall be capable of re-engagement to the thermostat, reheat to a minimum temperature of 480°C.

4.2.4 Knob Temperature: Knob temperature at initial release shall remain below 35°C. Re-energizing three times, with 60 second intervals between release and re-engagement, knob temperature shall remain below of 60°C.

4.2.5 Knob Retention: The lighter knob shall be retained to the element portion of the sub-assembly such that it can withstand an axial pull of 90 N applied 10-15 seconds after release from heating.

4.2.6 Power Outlet Contact: In power outlets the positive contact shall be recessed a minimum of 1.0 mm or otherwise designed in such a manner that a coin, dropped flat into the receptacle, will not short the device. This design will also be such that a lighter element cannot make contact when pressed into the receptacle with a 110 N force.

4.3 Mechanical Requirements:

The devices must be manufactured free of any contamination that can affect form, fit, function, and appearance. All metal stampings are to be free of burrs, and assemblies and components must be free of sharp edges.

The following tests will use flat polypropylene test panels of at least 100 x 100 mm. Panels of both 2.5 and 3.0 mm thickness will be used. Panels will be prepared with a clean hole of 27.8 ± 0.25 mm diameter. Use of other materials, when desired, shall be specified by the purchasing document. Force shall be measured with a linear device of at least 300 N capacity.

4.3.1 Installation Forces: These devices shall be hand installed. Installation of the mounting ring to the panel and engagement of the receptacle (through the mount ring) to fully seated position shall not exceed 110 N, applied to the front face of the base unit, in a straight line along it's central axis. (Note: Ergonomic requirements suggest that components with installation forces greater than 110 N should have an installation tool). Indexing or orientation of the complete assembly to the parent panel at installation shall be provided in such a way that it does not interfere with either the installation or function of either device.

4.3.2 Mounting Retention: The device shall retain to the parent panel such that a minimum 260 N push or pull along the central axis will not unseat the device from the panel. Unseating shall be defined as; mount ring failure, mount ring to panel failure, mount ring to receptacle failure, or permanent deformation of any component allowing looseness of the components relative to one another.

4.3.3 Orientation: The manufacturer shall ensure that the device is designed to operate in all orientations. As a result of these orientation requirements, the lighter shall be so designed that during it's life the combination of retention and popout characteristics shall prohibit ejection of the element from the receptacle on being released from engagement after heating.

4.3.4 Element Shield: An element shield or ash guard shall be provided such that the hot element cannot make contact with any surface of a spherical radius of 75 mm or greater. If this is accomplished with a retractable or sliding device, the shield shall operate at a minimum of 2.2 N to a maximum of 8.4 N force. At no time shall the efforts for ash guard operation exceed the forces required for insertion or removal of the element from the base.

4.3.5 Concentricity: The knob, the element, the ash guard, the receptacle assembly, and all mating parts shall be uniformly concentric to eliminate any chance of the coil holder shorting between the base and the bi-metallic thermostat fingers, and to assure proper appearance regardless of element orientation.

Normal clearances shall have no effect on element operation, nor result in any detrimental buzz, squeak, or rattle effects.

4.3.6 Actuation Forces: The forces required to insert, engage, disengage, and remove the element from the receptacle shall be as follows:

Insertion to Receptacle	Less than 27 N
Engage to Heat	13 N to 36 N
Remove from Receptacle	Less than 36 N
Disengage without heating at ambient	Less than 45 N

Unless otherwise specified, these forces shall be the average of 3 readings taken with the element rotated 90° between each reading. When used as a power outlet, the receptacle shall withstand plug insertion and extraction forces of 36 N.

4.3.6.1 Off-Axis Force: The element shall properly engage and function when depressed with a force applied "off-axis". The component of force normal to the lighter axis shall be one-third the measured force to engage with a straight push. The force shall be applied at 30 degree increments around the axis.

4.3.6.2 Excessive Force: No device (element assembly or receptacle) shall be damaged by the application of up to 220 N of "excessive" force in the direction of engagement.

4.3.6.3 Side Loading: The knob shall not be affected by a side loading force of up to 110 N applied at a point 12 mm from the junction of the knob and element. The force shall be applied normal to the axis of the lighter with the element inserted but not engaged for heating.

4.3.7 Terminal/Connector Requirements:

4.3.7.1 All electrical testing shall be done with production approved wiring and terminals which conform to the part drawing. Note: All lighter and outlet circuits are intended to be wired and fused at a minimum of 15 A and a maximum of 20A.

4.3.7.2 When assembled to the receptacle, the electrical terminations must withstand a steady, right angle, pull of 50 N applied to the wires with no loosening, grounding, or reduction in performance of the device.

4.4 Electrical Requirements:

4.4.1 Normal Voltage: Electrical parameters of the automobile require that electrical devices operate on a voltage range of 9.0 to 16.0 VDC. The cigar lighter is expected to function reliably within this range and specifically at the ranges shown in the chart below.

9.0 - 11.5 ± 0.1 VDC	Some performance degradation* allowed but no damage or permanent degradation allowed.
11.5 - 15.0 ± 0.1 VDC	Must meet all specifications
15.0 - 16.0 ± 0.1 VDC	Some performance degradation* allowed but no damage or permanent degradation allowed

* Performance degradation shall be limited to variations in pop-out timing and/or element temperatures.

4.4.2 Current Draw: Current draw for a properly operating lighter assembly shall be no more than 10.0 A @ 14.2 VDC. The power outlet, and the lighter receptacle when used as a power outlet, shall be rated at 20 A. Current shall be monitored throughout testing. As a development test, both power outlets and lighter receptacles shall be tested for long duration (1 hour) power outlet over-currents of 25 A using a plug meeting the requirements shown in Paragraph 5.4.

4.4.3 Parasitic Load: Neither the lighter assembly nor the power outlet assembly shall draw any current in the de-energized state.

4.4.4 Electromagnetic Compatibility (EMC): The lighter shall produce no conducted or radiated emissions into the vehicle electrical system or environment other than those associated with making or breaking DC electrical contacts.

4.4.5 Thermal Protection: Thermal protection is to be provided in the lighter receptacle. Thermal protection is to be accomplished with a shunt device, activated by thermal (overheat) conditions. At actuation, the shunt will short the supply (B+) line to ground with a maximum impedance of 50 milli-ohms. The over temperature shunt shall not weld shorted when subjected to five successive over temperature cycles, and with the line fuse replaced between each cycle. Temporary welds that self clear immediately upon fuse replacement, are allowed. The over temperature device shall activate within 60 seconds at 14.2 ±0.1 VDC after engaging, when holding the element in the engaged position.

Over temperature source for this test may be obtained by holding an element assembly in the engaged position or by use of an alternative heat source that replicates the element in heat profile and location. The receptacle shall be horizontally mounted in an enclosed or baffled space of approximately 1000 cc. essentially free of air circulation.

4.4.6 Reverse Voltage: Lighter assemblies shall not be damaged by an application of reverse voltage of -14.2+/-0.3V for 30 seconds with the element engaged. Release from the engaged position is allowed at any time while meeting this requirement.

4.4.7 Over Voltage: Vehicles are occasionally subjected to voltage "spikes" during the course of their lives. Lighter assemblies shall not be damaged by an overvoltage of 24.0+/-0.5 VDC applied for 30 seconds with the element inserted, but not engaged and again with the element removed.

4.4.8 Isolation Resistance: Receptacles shall withstand +440VAC @ 60HZ for one minute with no arcing or shorts (voltage breakdowns). Isolation resistance between terminals shall be a minimum of 20 Megohm. This test shall be conducted with the element in the normal, inserted but not engaged, position and again with the element removed.

4.5 Component Environmental Requirements:

4.5.1 Shock/Drop Tests: Drop tests shall be conducted to demonstrate both the part integrity and shipping package integrity. No dents, bending, scratches, cracks, or other damage shall be allowed as a result of these tests. Samples shall not be affected by any of the following tests:

A. BOX DROP TEST: Test "A" is a drop test consisting of three drops of a fully packaged box of components, from a height of 1.52 M, onto a flat concrete floor in each of three different orientations. This test simulates a deceleration of 292.6 m/sec.

B. SHOCK TEST: Test "B" consists of three shocks, applied to the component, of half sine wave, 13m/sec duration (nominal) pulses producing 25g peak acceleration in each of 6 directions along 3 mutually perpendicular axes (18 shocks total).

C. COMPONENT DROP: The component must be capable of withstanding a 1.0m drop onto a solid concrete floor in the same 6 directions as Test "A" without visible damage or degradation of performance.

4.5.2 Thermal Shock: Thermal shock resistance shall be tested by exposure to 10 thermal shock cycles of +85°C to -40°C to +85°C with a maximum transition time of 2 minutes and a minimum dwell time of 30 minutes at each temperature. The assembly shall continue to meet functional requirements after this test.

4.5.3 Temperature Requirements: These devices are expected to operate within the typical automotive temperature range of -40°C to +85°C with no damage or degradation to performance of the component. This temperature range is extended to +125°C for shipping and storage requirements.

Test samples shall be mounted to a suitable test panel, and the temperature raised to 125°C for 4 hours. Reduce temperature to +85°C and allow to stabilize for 2 hours. Operate lighter 5 times at 3 minute intervals, checking release time and maximum current. Reduce temperature to +50°C and allow to stabilize for 1 hour. Operate lighter 5 times at 3 minute intervals, checking release time and maximum current. Lower temperature to -18°C and allow to stabilize for 1 hour. Operate lighter 5 times at 3 minute intervals, checking release time and maximum current. Lower temperature to -40°C, stabilize for 4 hours, operate lighter 5 times at 5 minute intervals, checking release time and maximum current. Performance shall be as follows:

+85°C	Lighter shall not malfunction or be damaged. Performance degradation* is allowed.
+50°C	Lighter shall meet requirements.
-18°C	Lighter shall meet requirements.
-40°C	Lighter shall not malfunction or be damaged. Performance degradation* is allowed.

* Performance degradation shall be limited to change in release time and/or element temperature.

The low temperature (below ambient) tests need not follow immediately after the high temperature tests.

4.5.4 Humidity Testing: Humidity testing shall consist of 4 hours of 98% RH condensing humidity at 65°C, followed by 4 hours of 50% RH. During this test the assemblies shall continue to meet functional requirements for current draw and/or trip times when cycled at the rate of once per hour.

4.5.5 Corrosion Resistance Requirements: There shall be no visible corrosion, nor degradation of functional requirements when subjected to a 5% salt fog for 8 hours in accordance with ASTM B117. After exposure, the samples are to be gently rinsed in slowly running clear, warm (38°C max.) water and then dried with clean, low pressure (240-275 kPa), compressed air, or allowed to air dry at room temperature before examination and testing. Performance at conclusion of testing shall consist of 25 cycles, measuring current and release time. Specific internal components may be exempted from the visible corrosion requirement only, on approval of the customer's responsible engineer.

4.5.6 Liquid Spill Resistance Requirements: Position twelve receptacles (two for each contaminant material, one with and one without element/plug) in vertical position (opening up), at standard room temperature and humidity, connect to power supply set for 14.2 ± 0.1 VDC, do not actuate to heat cycle. Spill or splash 60 ml of each of the materials listed below into each device. Air dry at room temperature for one hour, insert element assemblies into the empty lighter receptacles, and check component for function by attempting to cycle. Repeat functional check after 11 more hours of drying time and again after 24 hours. Record any changes from "design condition" at the end of 24 hours. This test does not require full functionality to all requirements for a successful completion. However, the over-temperature protection shall function as specified at the end of the 24 hour drying time. A functional check shall be attempted by holding the element engaged for one over temperature activation. Failure of the element to engage will constitute success by default.

Liquid	Test Solution
Coffee	Commercial
Cola	Commercial
Water	Commercial
Alcohol Base Cleaner	Commercial, 10% by Vol.
Ammonia Base Cleaner	Commercial, 10% by Vol.
Hand Lotion	Commercial

4.5.7 Vibration Resistance: The lighter assembly shall withstand three random vibration tests, of 2 hours each, in three mutually perpendicular axes of 2.37 g RMS with the assembly powered but without the element engaged and again with the element engaged (but unpowered). There shall be no damage, degradation of performance, or unintended operation. The lighter shall be actuated for one cycle every 15 minutes during the test.

During this test, the devices shall be monitored for any evidence of Buzz, Squeak, or Rattle. Final acceptance for Buzz, Squeak, or Rattle shall be at the vehicle level.

The vibration shall be 2.37 g RMS from 10 to 2000 Hz, applied for 2 hours in each axis (6 hours total) with spectral density as specified by the following:

Breakpoint Frequency	Power Spectral Density
10 Hz	0.02 g^2/Hz
20	0.05
40	0.05
800	0.001
2000	0.001

4.6 Reliability Requirements:

The objective of this standard is to develop components that are capable of operating in their intended environment and application for a minimum period of 10 years. The performance objective for the lighter is 10,000 heating cycles, under various conditions, with no failures. The performance objective for the power outlet is also 10,000 cycles, combining insertion/extraction with powered operation. The tests described in this standard are intended to verify this capability.

The reliability requirement for this product is a minimum 95% reliability with 65% confidence at ten years of product life: R95, C65. This shall be demonstrated using Weibull analysis techniques, by subjecting a random sample of assemblies to a life test as follows:

4.6.1 Reliability Test Schedule: The test equipment for this test shall be designed and operated to meet the following schedule:

a. Insert the element or plug into the receptacle (the knob may be modified for attachment to the test equipment, and a guide at the receptacle entry).
(for outlets) A resistive load shall be continuously connected to the plug for these tests. The load shall be a pseudo-random mixture of 20A for approximately 25% of the cycles, and 5A for 75% of the cycles.
b. *(for lighters)* Engage the lighter and then remove the force in such a manner that release from engagement is unrestricted. Measure current and release time for each cycle.
c. *(for lighters)* After 20 seconds, remove the lighter from the receptacle.
(for outlets) After 20 seconds, remove the plug from the receptacle.
d. *(for lighters)* Allow to cool to less than 40C (forced air cooling is allowed).
e. Begin next cycle. The element or plug shall be rotated between each insertion so that engagement position is varied.
f. *(for lighters)* At the start and after each 25% of the test, the test shall be paused and the heat profile of the element shall be measured.

A failure of the lighter will be counted if current, release time, or heat profile are out of specification. A failure of a power outlet will be the inability to carry the required current.

4.6.2 Durability Requirements: These devices are intended to meet the durability cycle life described above. Testing to demonstrate this durability is covered by the reliability test described above. At least six devices shall be tested to a minimum of 10,000 cycles during reliability testing to satisfy the durability requirement. No additional testing for durability is required.

5. TESTING:

The tests required by this document must be accomplished in accordance with the procedures outlined herein, or referenced documents. Tests are specified in Section 4 along with the requirements.

All data based on laboratory testing shall be from an accredited laboratory. Documents verifying accreditation shall be available for inspection.

The vendor shall have a thorough understanding of all requirements prior to beginning any testing or parts submittal. Any deviations from these requirements must be agreed to in writing by the customer.

Test conformance shall be determined by meeting all requirements of the test in question. All samples shall satisfy the performance requirements regardless of age, number of cycles, or temperature. Demonstration of conformance to this standard shall be the, documented, successful completion of all requirements contained herein.

5.1 Test Sequence:

The test sequence and allocation of test samples among the tests is shown in Fig 1, Validation Test Schedule.

Some tests, are by nature destructive, and will render a sample unfit for further evaluation. These tests have been scheduled last in each sequence.

5.2 Test Samples:

5.2.1 Sample Identification: Engineering test samples shall be identified by part number and test serial number unless otherwise noted. The supplier shall develop a system which denotes, at least, the part number, date of manufacture, customer, development level, and special assembly process (if any) used in producing the part.

5.2.2 Sample Selection: Samples for testing shall be taken from the latest level of the available parts supply stream depending on the level of parts themselves; prototype, program/pilot, or production. Random selection is a prime consideration except for those production parts which must represent a cross section of production processes, such as multiple mold cavities, etc. Samples shall have been subjected to all normal processing and handling including final packing (excluding final sealing of the shipping container) if possible.

5.2.3 Performance: Test samples shall be evaluated immediately before testing, after each phase (when required), and at the conclusion of all testing. Performance shall be 5 actuations of 5 minutes intervals monitoring current draw and release time.

5.2.4 Sample Disposition: When samples are no longer required for test, whether they have been subjected to testing or not, they shall be scrapped. The only exception shall be for production audit samples that are not subjected to any intrusive examination or testing, and have accumulated less than 10 cycles of actuation, these parts may be returned to the production stream.

5.3 Test Equipment:

Test tolerances, in all cases, shall be as stated in the appropriate paragraph(s). Any deviations from these tolerances shall be cause for test failure.

5.3.1 Calibration: All measurement equipment is to be calibrated and documented to working standards traceable to a national standard system. Calibration must occur at least as often as recommended by the manufacturer of the equipment, but not less than once per year.

5.3.2 Measurement Accuracy: Measuring devices used for purposes of this standard shall be capable of one order of magnitude greater than required. For example, if a dimension is two decimal places (x.xx), the measuring device must be capable of three decimal (x.xxx) place readings.

5.3.3 Test Repeatability: Equipment repeatability studies (Gage R&R) shall be performed and documented on all specially designed or automated test fixtures and equipment after initial calibration, but prior to use for product evaluation. These studies shall assure that test equipment variability will not allow the acceptance of bad product nor the rejection of good product. These results shall be retained for evaluation during Process Sign Off (PSO) and PPAP.

5.4 Test Plug:

This section describes the requirements for the electrical plug to be used to test the lighter and outlet receptacle. It also describes the recommended design for after-market device plugs to connect to the vehicle electrical system using the lighter or outlet receptacle.

For purposes of testing power outlets, and lighters when used as a power outlet, a plug meeting the requirements of these paragraphs and Figure 4, Version 1 shall be used.

It is recommended that all aftermarket devices use plugs meeting these requirements. In particular, the retention forces shall be such as to maintain the minimum B+ contact force when subjected to vibration and shock loading specified herein.

5.4.1 Requirements: Power Outlet Plugs shall be governed in part by SAE Standard J563 MAR90. Additional requirements of plug insertion/extraction forces, increased current carrying capacity, dimensions, and an alternative construction are added. The purpose of these requirements are to ensure that the power plug fits snugly into the lighter base and does not back out due to spring pressure at the center (B+) terminal, nor does an overly tight fit occur.

The plugs shall meet the requirements of Figure 4 and the following:

Insertion/Extraction Force	36 N max.
B+ Contact Force	4 - 10 N
B+ Contact Diameter	2 - 5 mm
B+ Contact Tip Shape	Shall not be pointed.
Gnd Contact Force	4 N min.
Retention Forces Total	Shall prevent B+ contact from dropping below 4 N when subjected to the vibration schedule of paragraph 4.5.7.
Plug Rotation	Design shall be such that rotation of plug shall not cause locking or interference with lighter retention fingers or openings in sidewall of receptacles.

5.5 Visual Inspection:

The importance of a thorough visual inspection by a qualified operator cannot be over emphasized. Visual inspections include, but are not limited to: discolorations, die shift on molded parts, loose fits, buzz, squeaks, rattles, mismatched component parts, flash, burrs, rough edges, deformed parts, binding, and subtle subjective changes in operation or appearance. Visual inspection is a requirement at every stage of testing, whether explicitly stated or not.

5.6 Component Performance Checks:

Basic performance checks shall be performed to insure proper function or to establish a data baseline. These "functional" checks will be taken prior to testing and between tests to ensure continuous operability of parts. These tests are intended to mimic those functional checks which should be used in the production process to detect bad parts. These checks should become part of a normal production process.

Cycle Check. Lighters should be cycled 5 times, monitoring current draw and release time. Outlets should have the load connected and disconnected 5 times with a nominal 20 amp resistive load, noting any degradation in current carrying capacity.

Mechanical Function. Lighters should be inserted, engaged, and removed, monitoring forces and smoothness of operation. Outlets should have the test plug inserted and removed, monitoring smoothness of operation and change in forces from original baseline.

Visual Inspection. Devices should be given a thorough visual inspection as described above, noting any changes from their original baseline condition.

6. REPORT REQUIREMENTS:

Conformance reporting shall be done at the end of each phase of testing. A Process Sign Off (PSO) shall be performed prior to any shipment of production parts to any assembly plant. Continuing Conformance Test results shall be reported regularly throughout the production life of the part.

6.1 Required Data Package-AIAG Standard:

The required data package, in accordance with AIAG standards, is to be included with the sample submission in accordance with the customers submission policies as part of the Production Part Approval Process (PPAP). The data package shall include all appropriate performance and test data, statistical distributions for each performance parameter, and the serial number of each part in the sample submission. Parts shall be shipped in containers which simulate production packaging when required.

PREPARED BY USCAR/EWCAP SUBCOMMITTEE FOR
CIGAR LIGHTERS AND POWER OUTLETS

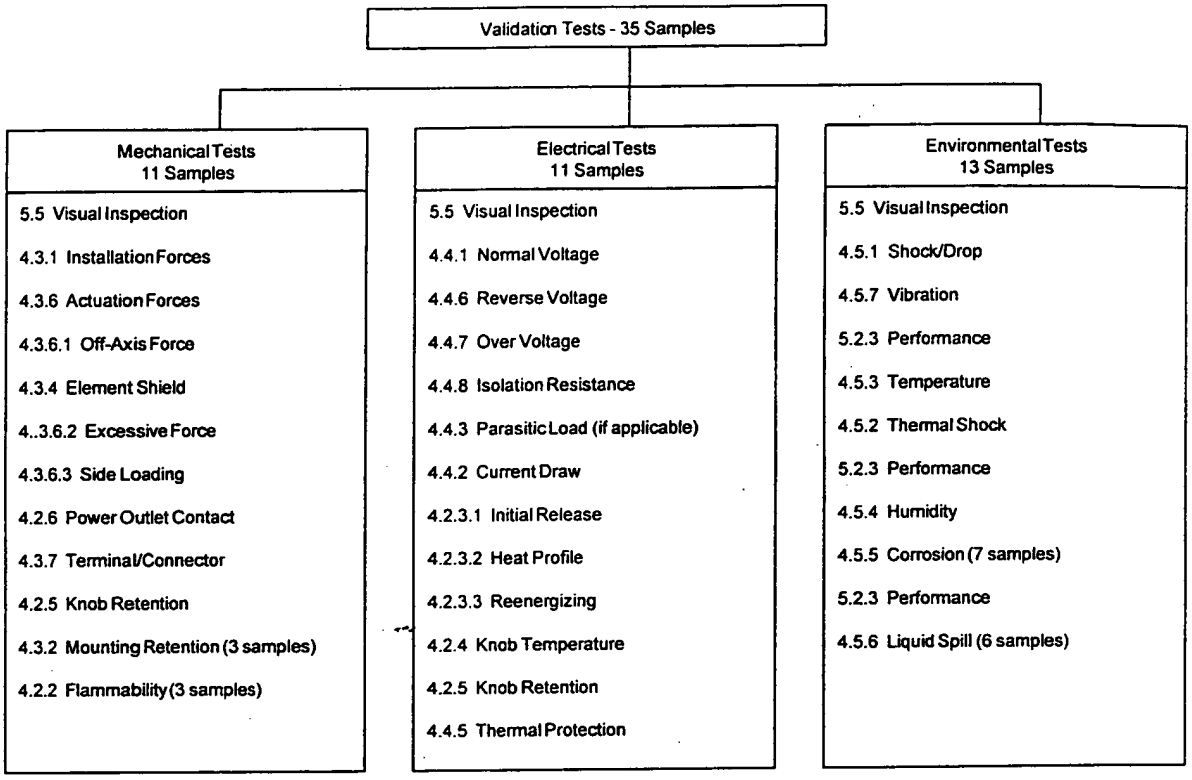


FIG. 1. VALIDATION TEST SCHEDULE

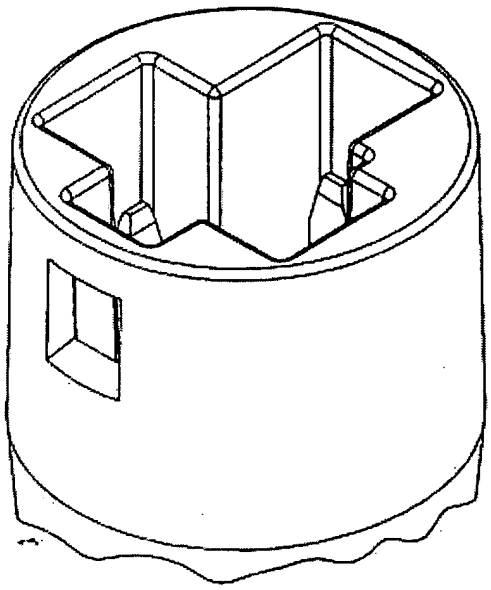


Fig. 2A ELECTRICAL CONNECTION VIEW

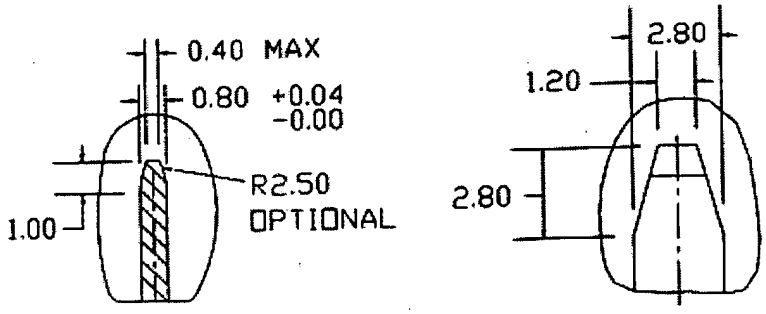


Fig. 2B TERMINAL TIP CONFIGURATION

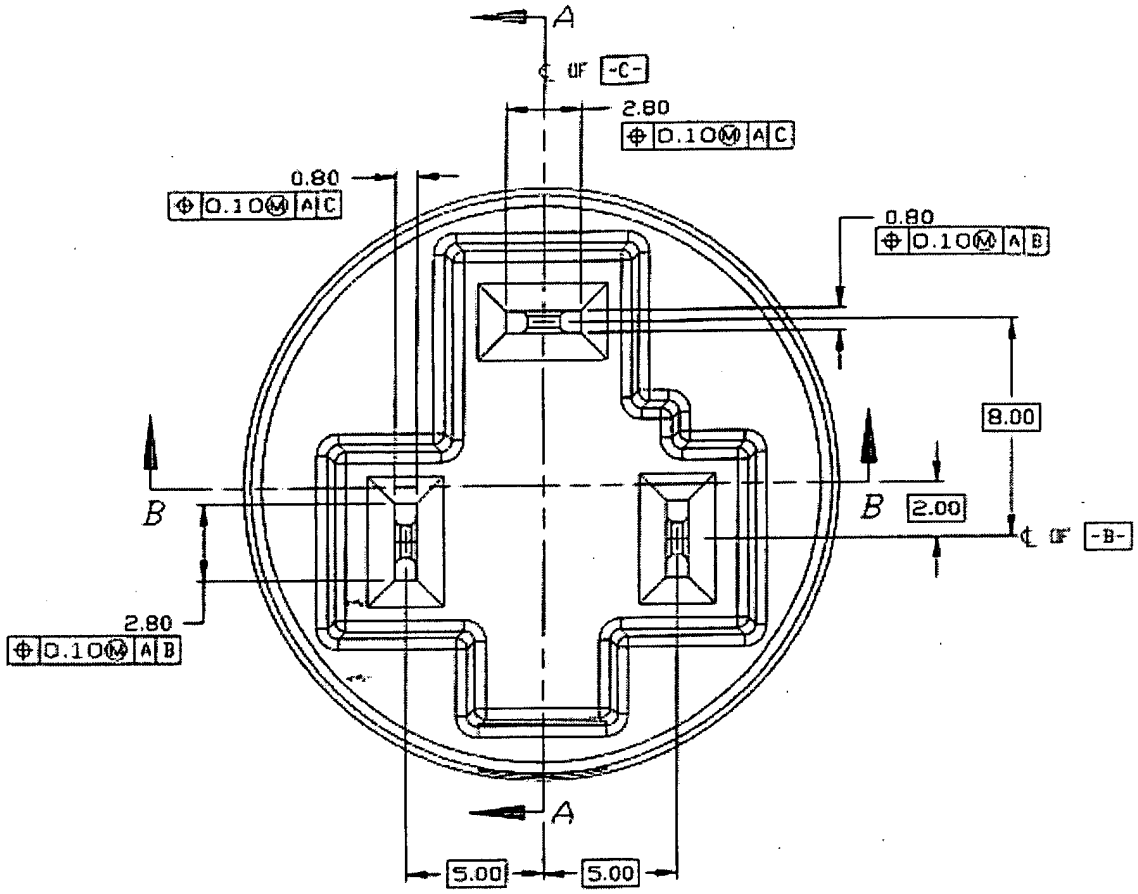


Fig. 2C CONNECTOR PLAN VIEW

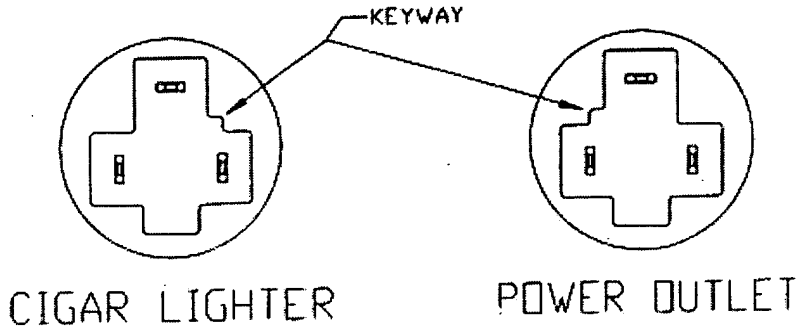
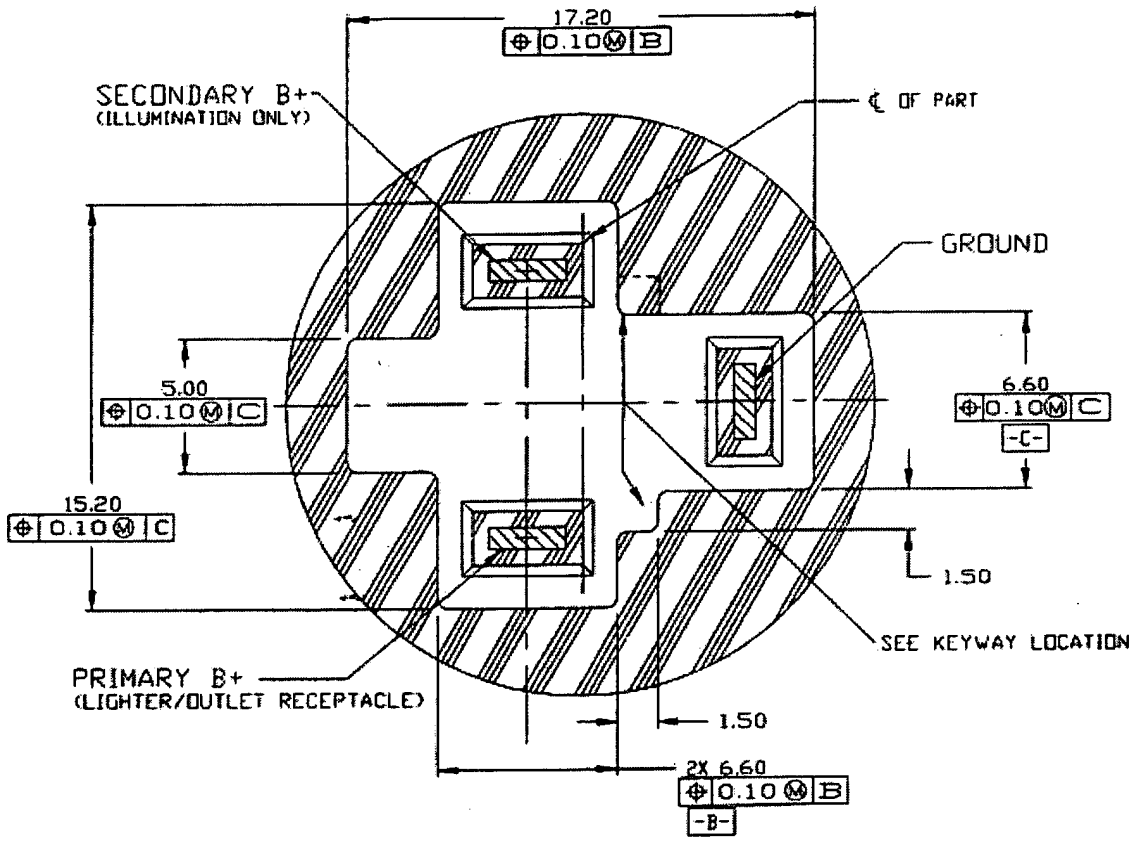
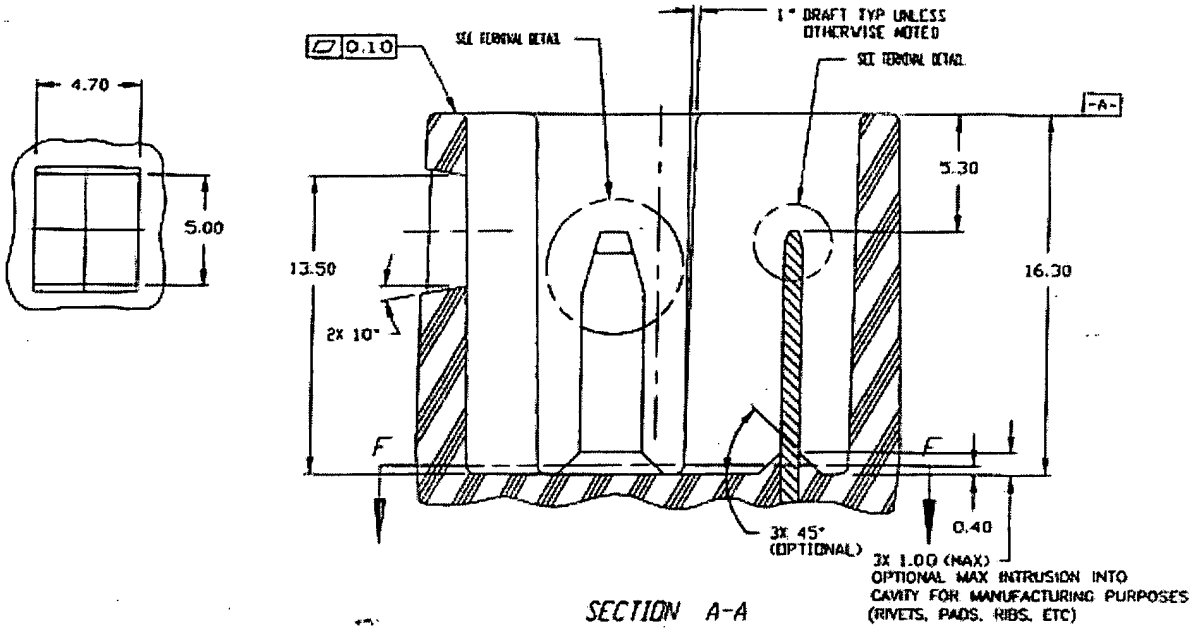


Fig. 2D CONNECTOR KEYWAY LOCATION DETAIL

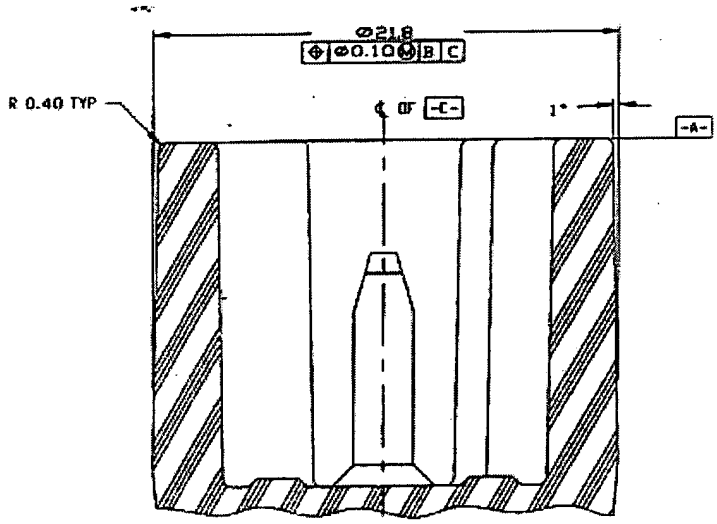


SECTION F-F

Fig. 2E CONNECTOR PLAN SECTION



SECTION A-A



SECTION B-B

Fig. 2F CONNECTOR VERTICAL SECTIONS

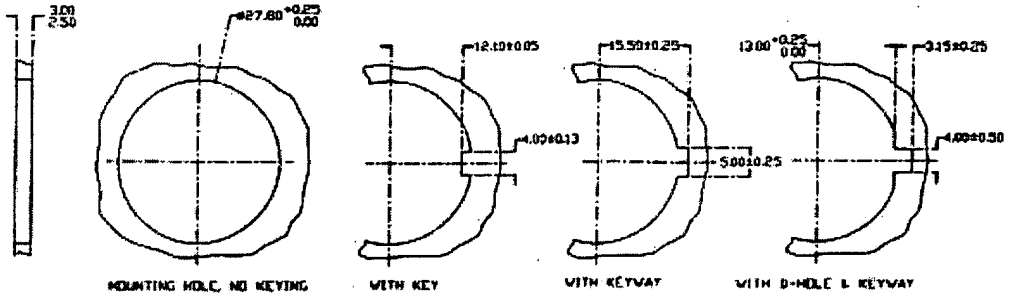
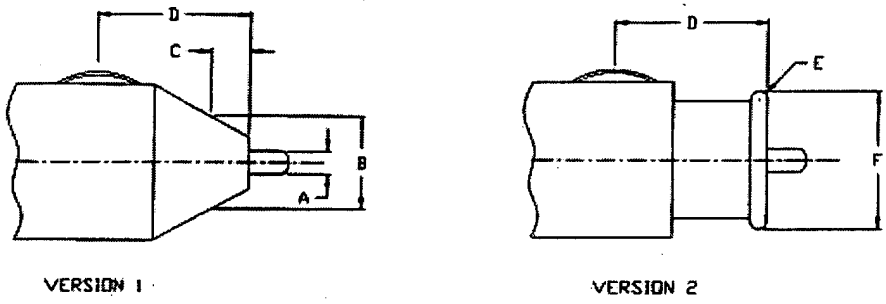


Fig. 3 PANEL MOUNTING HOLE DIMENSIONS AND PREFERRED KEYING

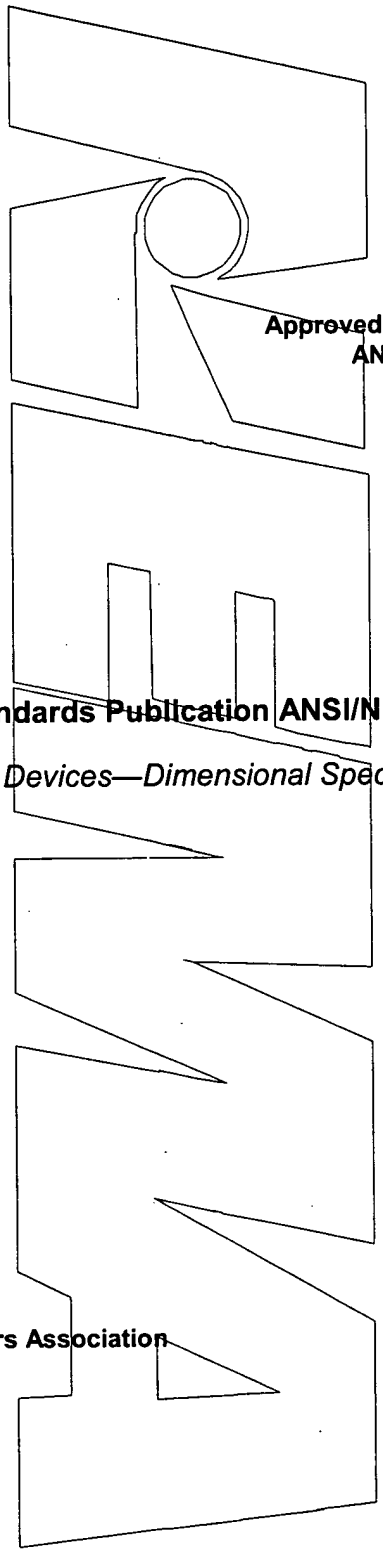


	FEATURE	VERSION 1	VERSION 2
A	+ CONTACT DIAMETER	2 - 5 MM	2 - 5 MM
B	MAX. DIAM. AT CLEARANCE POINT	12 MM	
C	CLEARANCE POINT FOR THERMOSTAT	5 MM	
D	LOCATION OF GROUND CONTACT	25 MM MAX.	25 MM MAX.
E	RADIUS OF THERMOSTAT LATCH		0.9 MM MIN.
F	DIAM. OF THERMOSTAT LATCH		17.8 MM

NOTE: SEE ALSO APPLICABLE PARAGRAPHS

Fig. 4 TEST PLUG CONFIGURATION

EXHIBIT C



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Wiring Devices—Dimensional Specifications

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CONTENTS

Forew rd

The purpose of these Standards is to present the dimensional requirements of wiring devices in order to assist the user in selecting and obtaining the proper product for a particular need and to minimize the possibility of unsafe interchangeability between configurations.

In the preparation of this Standards Publication, input of users and other interested parties has been sought and evaluated. User input will be formally sought by the canvas procedures of the American National Standards Institute.

The Communications Department has worked closely with the Engineering Department and with individual NEMA Subdivisions in the drafting of this manual and acknowledges the need for periodic review and updating. Proposed or recommended revisions should be submitted to:

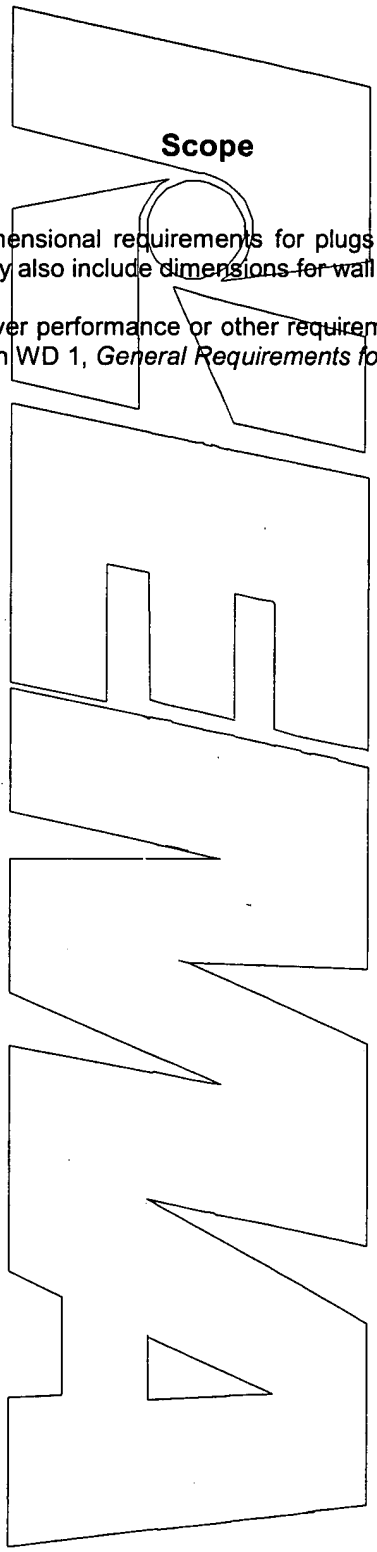
Vice President, Communications Department
National Electrical Manufacturers Association
1300 North 17th Street
Rosslyn, Virginia 22209

Publication ANSI/NEMA WD 6-2002 revises and supersedes NEMA Standards Publication WD 6-1997.

Scope

These Standards cover dimensional requirements for plugs and receptacles rated up to 60 Ampere and 600 Volts. They also include dimensions for wall plates.

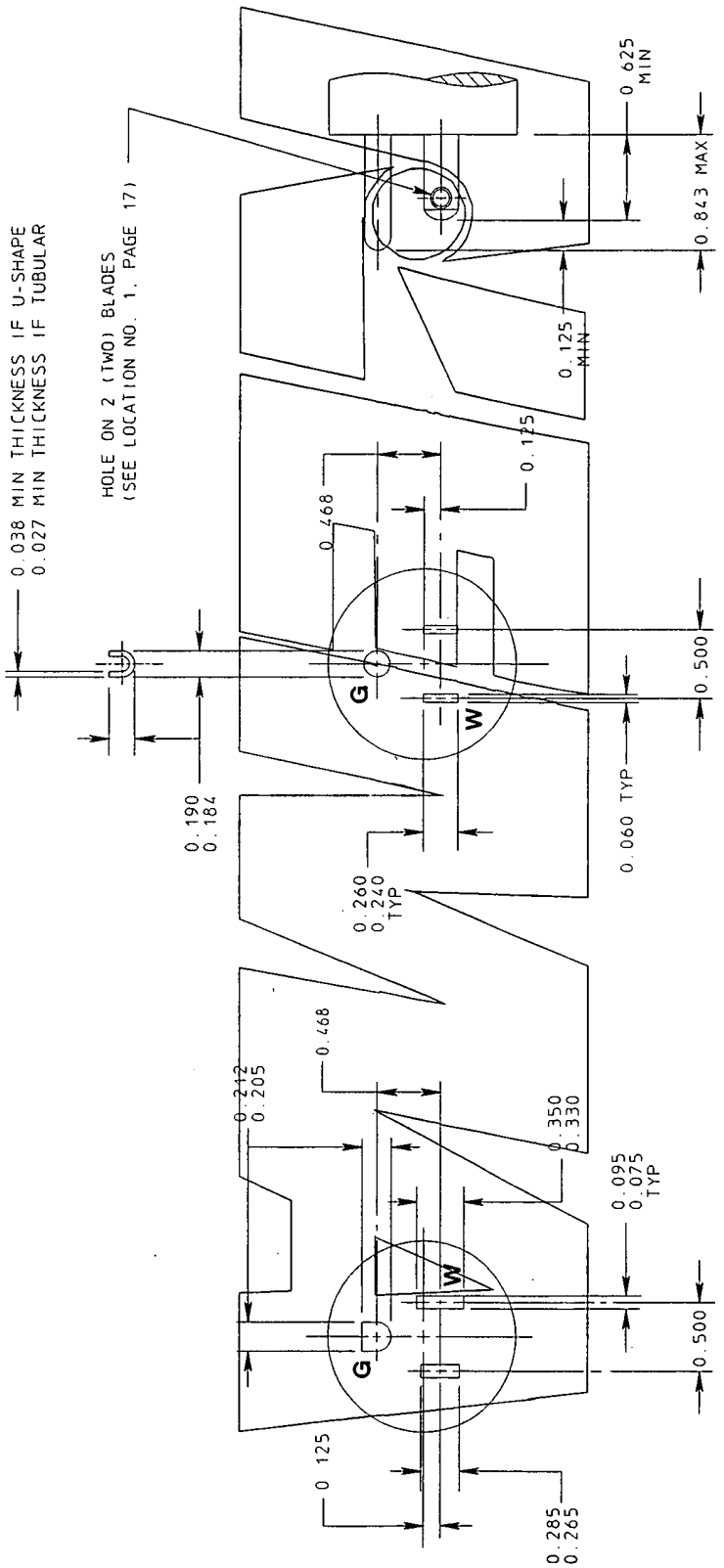
These Standards do not cover performance or other requirements since these are included in NEMA Standards Publication WD 1, *General Requirements for Wiring Devices*.



Intr duction

Throughout this publication the following shall apply:

1. All dimensions are in inches, unless otherwise specified.
2. Decimal dimensions without tolerances shall be subject to a plus or minus 0.005-inch tolerance.
3. Angular dimensions without tolerances shall be subject to a plus or minus 1 degree tolerance.
4. "G" denotes equipment ground.
5. "W" denotes system ground.
6. Leading edges of plug blades shall be free of burrs and sharp edges.
7. All slots and slot tolerances are symmetrically located about centerlines.
8. Female contacts associated with plug blades that are 0.125 minimum longer than other blades are engaged prior to the other female contacts.
9. Configurations utilized on alternating current systems are limited to 50 or 60 Hertz, unless otherwise specified.
10. Dimensions shown in these standards are for the purpose of interchangeability, and do not preclude other designs.
11. The electrical ratings of the configurations in these standards are AC and DC, unless specifically stated 'AC' or 'DC.



NOTE: FOR TYPICAL DUPLEX OR RECTANGULAR STYLE DEVICES SEE PAGES 10, 11, AND 12.

FIGURE 5-15
PLUG AND RECEPTACLE
125 volts, 15 amperes, 2 pole, 3 wire, Grounding type